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PATENT

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Case Docket No.: 99,509

ASSISTANT COMMISSIONER FOR PATENTS
Patent Application
Washington, D. C. 20231

Date: February 5, 2000



Sir:

Transmitted herewith for filing is the patent application of:

Inventor: Dale J. Crook

For: FLEXIBLE DUCT SLEEVE

Enclosed are:

- X Abstract of the Disclosure (1 page) and
- 15 Pages of Specification and Claims
- 7 Sheets of drawings
- X Declaration and Power of Attorney
- X Verified statement(s) to establish small entity status under 37 C.F.R. 1.9 and 37 C.F.R. 1.27
- X The filing fee has been calculated as shown below:

				<u>SMALL ENTITY</u>		<u>OTHER THAN A SMALL ENTITY</u>	
<u>FOR</u>	<u>NO. FILED</u>	<u>NO. EXTRA</u>		<u>RATE</u>	<u>FEE</u>	<u>RATE</u>	<u>FEE</u>
BASIC FEE	*****	*****		****	\$ 345 or	****	\$ 690
TOTAL CLAIMS	<u>20</u> - 20 = <u>0</u>		x	9	=	\$ <u> </u> or x	18 = \$ <u> </u>
INDEP. CLAIMS	<u>2</u> - 3 = <u>0</u>		x	39	=	\$ <u> </u> or x	78 = \$ <u> </u>
MULTIPLE DEPENDENT CLAIM PRESENTED				+ 130		\$ <u> </u> or +	260 = \$ <u> </u>
				TOTAL	\$ <u>345</u> or	TOTAL	\$ <u> </u>

X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Account No. 12-1660. A duplicate copy of this sheet is attached.

X Our check No. 53340 is also enclosed to cover, among other items, the above filing fee.

Respectfully submitted,

LITMAN, KRAAI & BROWN, L.L.C.

BY Mark Brown

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VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
BY INVENTOR

Applicant: Dale J. Crook

For: FLEXIBLE DUCT SLEEVE

As a below-named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 C.F.R. 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the above-entitled invention described in:

(X) the specification filed herewith.

() application Serial No. _____, filed _____.

I have not assigned, granted, conveyed or licensed, and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who, upon knowledge and belief, could not be classified as an independent inventor under 37 C.F.R. 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 C.F.R. 1.9(d) or a nonprofit organization under 37 C.F.R. 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

Name of Concern: None

Address of Concern:

I acknowledge my duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

25-00

Date

Dale J. Crook

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FLEXIBLE DUCT SLEEVE

Background of the Invention

1. Field of the Invention

The present invention relates generally to ductwork for heating, ventilating and air conditioning ("HVAC") systems, and in particular to a sleeve for protecting a length of flexible hose from crimping.

2. Description of the Prior Art

Hoses, ducts and conduits in various sizes and configurations are commonly utilized for conveying, routing and directing various substances and objects. In dynamic systems, examples of such substances include air which has been heated or cooled by heating and air conditioning equipment. In the construction industry such systems are commonly referred to as heating, ventilating and air conditioning (HVAC) systems.

Typical HVAC systems include runs of ductwork extending from the heating and air conditioning equipment to additional air handling equipment, or to distribution devices. Additional air handling equipment examples include variable air volume ("VAV") boxes which are located in plenum spaces in many commercial structures. Heated and cooled air is typically introduced into the occupied spaces of buildings by diffusers which direct the airflow in predetermined distribution patterns for maximizing the comfort of the occupants.

1 Routing ductwork from the air conditioning and heating equipment to the supply
2 diffusers often involves ducting routes which turn, bend and intersect with various
3 components and with other runs of ductwork. To accommodate such curved, angled, and
4 bent routing, flexible duct is commonly used for the final portions of the duct runs, which
5 terminate at diffusers or other components. Flexible duct also has the advantage of being
6 easily reconfigurable to accommodate changed space configurations and the like. Another
7 advantage of flexible duct is that it is available with insulation to avoid condensation
8 during cooling operation.

9 However, a disadvantage of flexible duct is that it tends to crimp when bent (Figs.
10 5a, 6a and 7a). For example, 90° turns into diffusers can crimp unprotected flexible ducts.
11 Crimping tends to restrict air flow and lower overall system efficiency. HVAC equipment
12 thus works harder and consumes more power to overcome flow resistance associated with
13 crimped flexible ducts.

14 A prior art solution to the problem of flexible duct crimping at diffusers and other
15 bending locations is to install metal elbows, as shown in Fig. 7b. However, such
16 additional components involve additional labor and material costs. Also, insulation may
17 be required and further increase the installation costs.

18 The present invention addresses these disadvantages of prior art flexible duct
19 installations. Heretofore there has not been available a sleeve for flexible duct with the
20 advantages and features of the present invention.

Summary of the Invention

In the practice of the present invention, a sleeve assembly is provided for flexible ducts. The sleeve assembly includes a frame comprising first and second frame sections selectively secured together by fastener subassemblies. The frame includes first and second ends and a longitudinal axis extending therebetween. The sleeve assembly can subtend an appropriate angle for supporting a length of flexible duct through a corresponding bend. The frame includes multiple rings formed by ring halves each located in a respective frame section. Each frame section also includes multiple longitudinal members interconnecting respective ribs. The sleeve assembly is adapted for accommodating various applications and installations involving flexible duct, either straight or bent.

Objects and Advantages of the Invention

The principal objects and advantages of the invention include:

providing a sleeve assembly for flexible duct;

providing such a sleeve assembly which reduces crimping in flexible ducts;

providing such a sleeve assembly which enhances air distribution system

efficiency;

providing such a sleeve assembly which can accommodate various flexible duct

bend configurations;

providing such a sleeve assembly which can be fabricated from various materials;

1 providing such a sleeve assembly which can eliminate the need for metal elbows
2 in air distribution systems;
3 providing such a sleeve assembly which can be manufactured from various
4 components; and
5 providing such a sleeve assembly which is economical to manufacture, efficient in
6 operation, capable of a long operating life and particularly well adapted for the proposed
7 uses thereof.

8 **Brief Description of the Drawings**

9
10 Fig. 1 is a perspective view of a sleeve assembly for a flexible duct embodying the
11 present invention.

12 Fig. 2 is an enlarged cross-sectional view thereof taken generally along line 2-2 in
13 Fig. 1.

14 Fig. 3 is a perspective view of a coupling thereof.

15 Fig. 4 is an enlarged, cross-sectional view of an alternative construction thereof.

16 Fig. 5 is a side elevational view of a first installation of the sleeve assembly.

17 Fig. 5a is a side elevational view of a prior art configuration of the installation
18 shown in Fig. 5.

19 Fig. 6 is a plan view of a second installation of the sleeve assembly.

20 Fib. 6a is a plan view of a prior art configuration of the installation shown in Fig.
21 6.

1 Fig. 7 is a side elevational view of a third installation of the sleeve assembly.

2 Fig. 7a is a side elevational view of a prior art configuration of the installation
3 shown in Fig. 7, including a crimped flexible hose.

4 Fig. 7b is a side elevational view of a prior art configuration of the installation
5 shown in Fig. 7, with a galvanized, sheet metal elbow transitioning from a length of
6 flexible duct to a ceiling diffuser.

7 Fig. 8 is a side elevational view of an installation of the sleeve assembly at a 90°
8 bend of a flexible duct, shown suspended from the underside of a floor slab.

9

10 **Detailed Description of the Preferred Embodiments**

11 **I. Introduction and Environment**

12 As required, detailed embodiments of the present invention are disclosed herein;
13 however, it is to be understood that the disclosed embodiments are merely exemplary of
14 the invention, which may be embodied in various forms. Therefore, specific structural
15 and functional details disclosed herein are not to be interpreted as limiting, but merely as
16 a basis for the claims and as a representative basis for teaching one skilled in the art to
17 variously employ the present invention in virtually any appropriately detailed structure.

18 Referring to the drawings in more detail, the reference numeral 2 generally
19 designates a sleeve assembly for a flexible member, such as a length of flexible duct 4.
20 Without limitation on the generality of useful applications of the sleeve assembly 2, the
21 flexible duct 4 received in same can comprise a portion of the ductwork in a heating,

1 ventilation and air conditioning (“HVAC”) system in a building.

2 The sleeve assembly 2 generally comprises a skeletal frame 6 secured together by
3 multiple fastener subassemblies 8.

4

5 **II. Frame 6**

6 The frame 6 comprises first (inner) and second (outer) frame sections 10a,b with
7 an inner radius (“IR”) arc 12a and an outer radius (“OR”) arc 12b respectively. A
8 longitudinal axis 14 extends between opposite ends 16 of the frame 6 in generally parallel
9 relation to the radius arcs 12a,b. A passage 13 follows the longitudinal axis 14 and
10 receives the flexible duct 4. The frame 6 includes a plurality of annular rings 18 each
11 comprising a pair of ring halves or ribs 18a,b associated with a respective frame section
12 10a,b. As shown, the frame 6 extends through an arc of approximately 90° and includes
13 four rings 18, two of which are located adjacent to the frame ends 16 and the remaining
14 two of which are located intermediate same whereby the rings 18 are spaced at
15 approximately 30° radial intervals forming gores 19 separated by respective adjacent
16 rings 18.

17 The inner frame section 10a includes an inside radius longitudinal member 20a
18 and a pair of side longitudinal members 20b which extend in generally parallel relation
19 with respect to the longitudinal axis 14 and interconnect respective ribs 18a. The outer
20 radius frame section 10b includes an outer radius longitudinal member 22a and a pair of
21 side longitudinal members 22b. The rings 18 adjacent to the frame ends 16 include loops

24 mounted thereon in radially-spaced relation for receiving ties 26 which are adapted for securing the frame sections 10a,b together.

III. Fastener Subassembly 8

The frame sections 10a,b are secured together by the fastener subassemblies 8, each of which includes a pair of tabs 30 mounted on respective side edges 11a,b of the frame sections 10a,b. Each tab includes an inner leg 30a, a connector 30b and an outer leg 30c (Fig. 2). As shown in Fig. 2, the tabs 30 can be located at the connections between the ribs 18a and respective longitudinal members 20a,b and 22a,b. With the frame sections 10a,b placed together with their respective side edges 11a,b adjacent to each other, the tab connectors 30b are located adjacent to each other with the tab outer legs 30c projecting outwardly.

Each fastener subassembly 8 further includes a respective coupling 32 with a channel 34 receiving the tab outer legs 30c and a slot 36 receiving the tab connectors 30b. Each coupling 32 includes an extension 38 adapted to be grasped by an installer to facilitate mounting same. The sleeve assembly 2 described thus far can be fabricated of sheet metal stamped and folded into the desired configuration.

1 **IV. Modified Embodiment Sleeve Assemblies**

2 A sleeve assembly 102 comprising a first modified embodiment of the present
3 invention is shown in Fig. 4 and can be molded from plastic or some other suitable
4 material. The sleeve assembly 102 includes a modified fastener subassembly 108 with a
5 first notched latch member 10a integrally formed with a respective first frame section 12a
6 and a second notched latch member 10b integrally formed with a second frame section
7 12b.

8 Still further, the sleeve assembly can have a generally tubular configuration which
9 is fully enclosed throughout its entire length with a solid exterior open only at its ends.
10 Such an enclosed or solid exterior configuration could be formed from molded plastic,
11 stamped sheet metal, etc. Sleeve assemblies can be fabricated with various numbers of
12 “gores” 19, which comprise the sections between respective rings. Thus, the frame 6
13 disclosed has three gores of approximately 30° each whereby the frame 6 subtends an
14 angle of approximately 90° (30° x 3 = 90°). However, other angular configurations and
15 other numbers of gores could be employed to meet the requirements of particular
16 installations.

17 Moreover, various angles, radii and diameters can be utilized. The material
18 comprising the frame can comprise, for example, plastic, fiber glass, sheet metal, wire,
19 carbon fiber, etc.

20 Still further, sleeve assemblies can be constructed of multiple chains thereof

secured together. Thus, straight pieces could be combined with elbows, and various angular configurations could be assembled from smaller, angle components or elbows.

V. Installations

Fig. 5 shows a first installation or application of the sleeve assembly 2 in an HVAC system 52 including a supply duct 54 and a round tap 56 connected to same. The sleeve assembly 2 secures the end of a length of flexible duct 4 to the round tap 56 and supports same through a flexible duct bend 5a. The sleeve assembly 2 can be secured to the flexible duct 4 and the round tap 56 by any suitable means, including mounting screws 58 extending through receivers 60 formed in the rings 18 adjacent to the frame section ends 16. Ties 26 can also be utilized for providing annular constriction of the sleeve assembly 2 on the flexible duct 4 and the round tap 56. The flexible duct 4 extends from the sleeve assembly 2 to a diffuser 62 mounted in a ceiling 64.

A prior art configuration is shown in Fig. 5a and illustrates a potential restricted flow choke point 66, which is avoided by the use of a sleeve assembly 2.

Fig. 6 shows an installation of a modified, extended length sleeve assembly 202 connecting a length of flexible duct 4 to a variable air volume (“VAV”) box 68. The extended length of the sleeve assembly 202 accommodates the operation of the VAV box 68 by providing a relatively straight length adjacent to the VAV box 68 inlet to enable its sensors to perform effectively pursuant to manufacturers’ recommendations.

Fig. 6a shows a prior art configuration for connecting a length of flexible duct 4 to

1 a VAV box 68 whereby a choke point 66 can occur. Moreover, with the prior art
2 configuration shown in 6a, the necessary uninterrupted straight run from the flexible duct
3 4 into the VAV box 68 is not accommodated.

4 Fig. 7 shows a sleeve assembly 2 coupling a length of flexible duct 4 directly to a
5 diffuser 62. Prior art construction details for this configuration are shown in Figs. 7a and
6 7b. Fig 7a shows the potential choke point 66 which can form if no special consideration
7 is given to maintaining the shape of the flexible duct 4 through a 90° turn as it enters a
8 diffuser 62. Fig. 7b shows a prior art solution to this problem wherein a galvanized
9 elbow 70 is connected to the flexible duct 4 and to the diffuser 62.

10 Fig. 8 shows another installation of the sleeve assembly 2 for supporting a length
11 of flexible duct 4 at a bend 4a thereof located intermediate a supply duct 54 and a diffuser
12 62.

CLAIMS

What is claimed and desired to be secured by Letters Patent is as follows:

1. A sleeve for a length of flexible duct, which comprises:
 - a) first and second ends;
 - b) a passage extending between and open at said ends, said passage selectively receiving the length of flexible duct;
 - c) a frame generally conforming to the exterior shape of the flexible duct and including first and second frame sections; and
 - d) a frame fastener for securing said first and second frame sections together with the length of flexible duct located in said passage.
2. The invention of claim 1 wherein said frame has a longitudinal axis extending between said sleeve ends and a curved configuration curving through an angle in the range of approximately 15 degrees to 180 degrees.
3. The invention of claim 2 wherein said sleeve ends lie in respective planes generally perpendicular to said sleeve axis.
4. The invention of claim 2 wherein said frame includes inner and outer radius arcs extending between said sleeve assembly ends.

5. The invention of claim 4 wherein said frame sections are joined together along at least one of said radius arcs.
6. The invention of claim 5 wherein said sections are joined together along both of said radius arcs.
7. The invention of claim 4 wherein said radius arcs are generally parallel to said longitudinal axis.
8. The invention of claim 3 wherein:
 - a) said frame includes first and second end rings located at said sleeve first and second ends respectively and an intermediate ring located intermediate said first and second end rings; and
 - b) a plurality of longitudinal members extending between and connecting said rings, said longitudinal members extending in generally parallel relation with respect to said longitudinal axis.
9. The invention of claim 8 wherein each said ring comprises a pair of ribs, each said rib being located in a respective frame section.

10. The invention of claim 8, which includes:
- a) an inner radius arc longitudinal member located along said inner radius arc and an outer radius arc longitudinal member located along said outer radius arc.
11. The invention of claim 10, which includes:
- a) a pair of side longitudinal members each located at a respective side of said sleeve and each being part of a respective frame section.
12. The invention of claim 1 wherein said frame fastener includes:
- a) a tab with first and second tab halves each mounted on a respective frame section; and
 - b) a coupling selectively receiving said tab halves with said fastener assembly in a closed configuration thereof.
13. The invention of claim 1 wherein each said frame section includes a solid, continuous exterior surface.
14. The invention of claim 11 wherein each said frame section includes a pair of side edges and a pair of side longitudinal members located adjacent thereto, said frame sections being fastened together along respective adjacent side edges.

15. The invention of claim 9, which includes:
 - a) a plurality of loops each mounted on a respective rib of a respective end ring; and
 - b) a pair of ties each encircling a respective end ring, said ties being received in said loops.

16. The invention of claim 1, which includes:
 - a) said frame comprising plastic;
 - b) said frame fastener comprising first and second notched latch members each mounted on a respective frame section; and
 - c) said frame fastener having an open configuration with said latch members disengaged and a closed configuration with said latch members engaged.

17. The invention of claim 8 wherein said rings and longitudinal members comprise sheet metal.

18. In combination with an air handling system of a heating, ventilating and air conditioning system including a supply duct, a diffuser and a length of flexible duct interconnecting same and including an arcuate bend, the improvement of a sleeve assembly which comprises:
 - a) a frame including:
 - 1) opposite first and second ends;
 - 2) an inner radius arc extending between said ends;
 - 3) an outer radius arc extending between said ends;
 - 4) an arcuate longitudinal axis extending between said ends in generally parallel relation with respect to said arcs;
 - 5) a plurality of annular rings, including a first end ring located adjacent to said frame first end, a second end ring located adjacent to said frame second end and an intermediate ring located between said end rings;
 - 6) each said ring lying generally in a plane perpendicular to said longitudinal axis;
 - 7) each said ring comprising an inner rib of said inner radius frame section and an outer rib of said outer radius frame section;
 - 8) each said frame section including a pair of arcuate side edges; and
 - 9) a passage extending between and open at said ends, said passage receiving said flexible duct; and

- b) a plurality of fastener subassemblies each mounted on said frame adjacent to said section side edges, each said fastener subassembly having an open position with said frame sections disengaged and a closed position with said frame sections engaged.

19. The invention of claim 18, which includes:

- a) at least one of said end rings including a plurality of receivers; and
- b) a plurality of mounting screws each located in a respective ring receiver and adapted for fastening said sleeve assembly to said flexible duct and/or said diffuser.

20. The invention of claim 18, which includes:

- a) said sleeve assembly comprising an elbow-configuration sleeve assembly with the first end of the frame thereof fastened to said diffuser; and
- b) a straight configuration sleeve assembly with first and second frame ends, said first end being connected to said elbow-configuration sleeve assembly frame second end; and
- c) said sleeve assemblies receiving said flexible duct.

Abstract of the Disclosure

A sleeve assembly for supporting flexible duct includes a frame with first and second frame sections. The frame sections are secured together by fastener subassemblies. The sleeve assembly accommodates flexible duct in various angular and straight configurations. The frame can comprise various suitable materials and skeletal or solid-exterior construction. The sleeve assembly is adapted for various installations in air distribution systems of heating, ventilating and air conditioning systems.

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FIG. 1

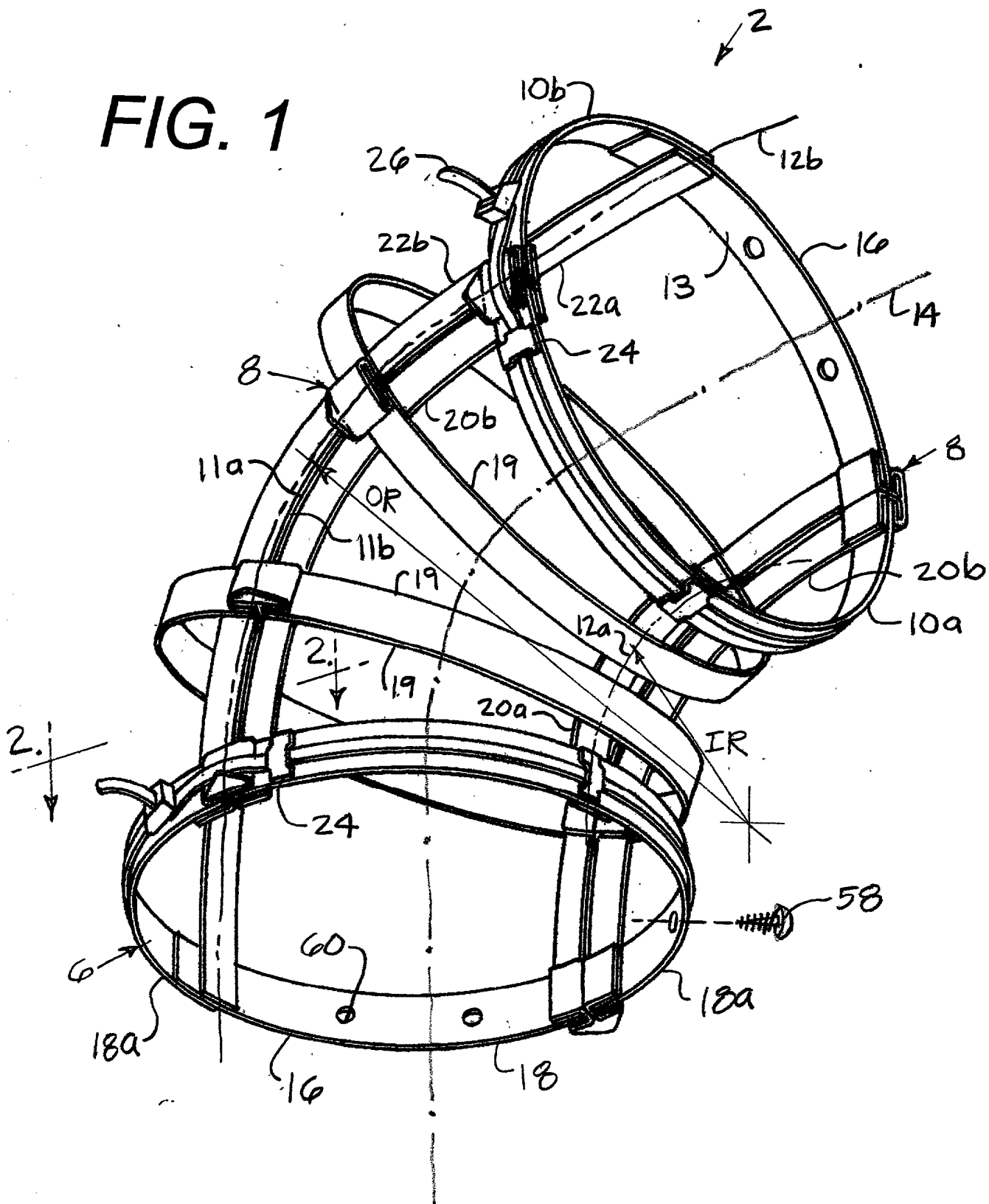


FIG. 2

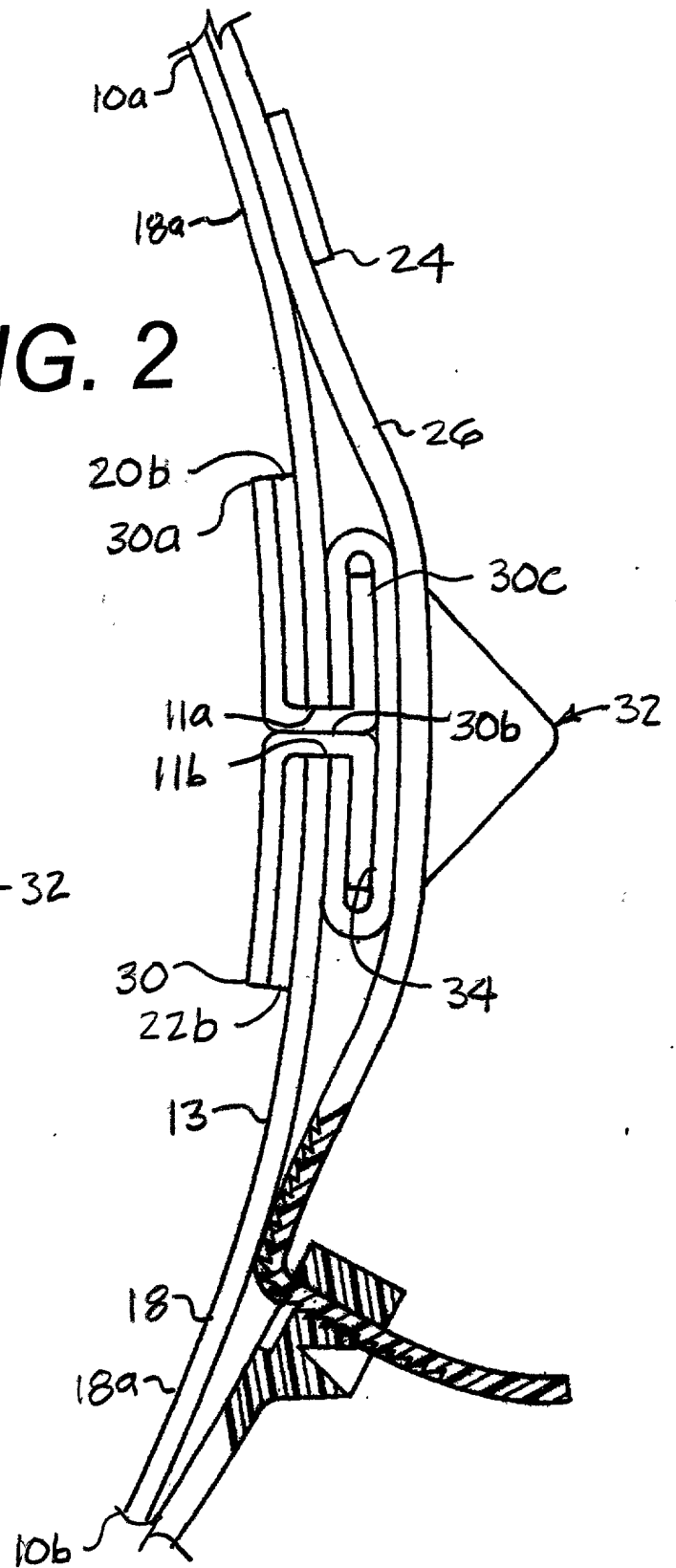


FIG. 3

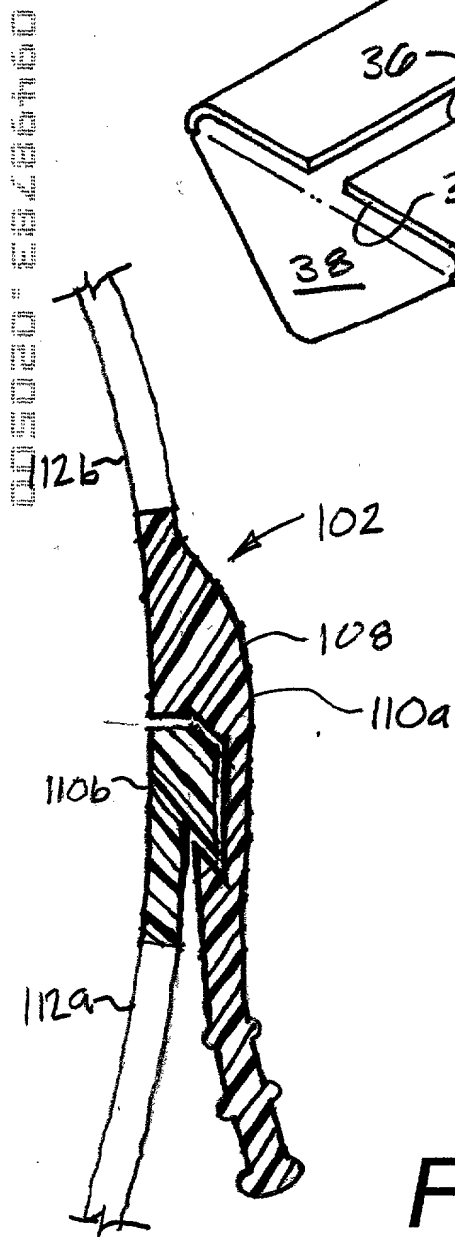
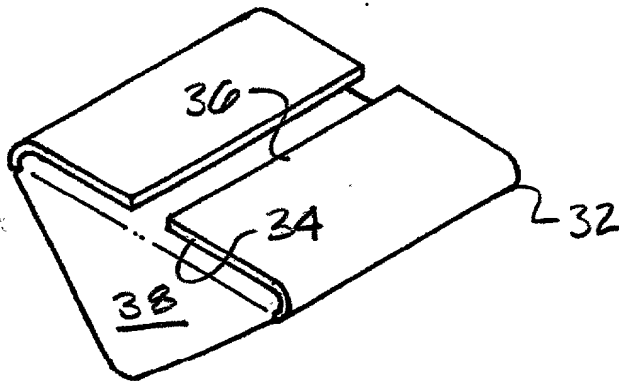


FIG. 4

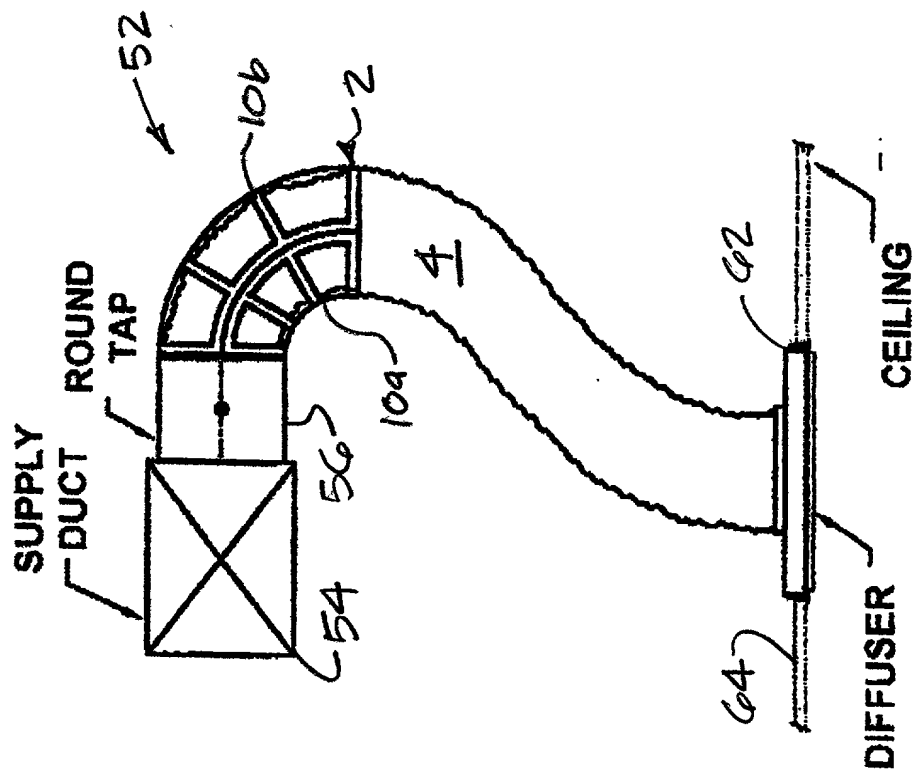


FIG. 5

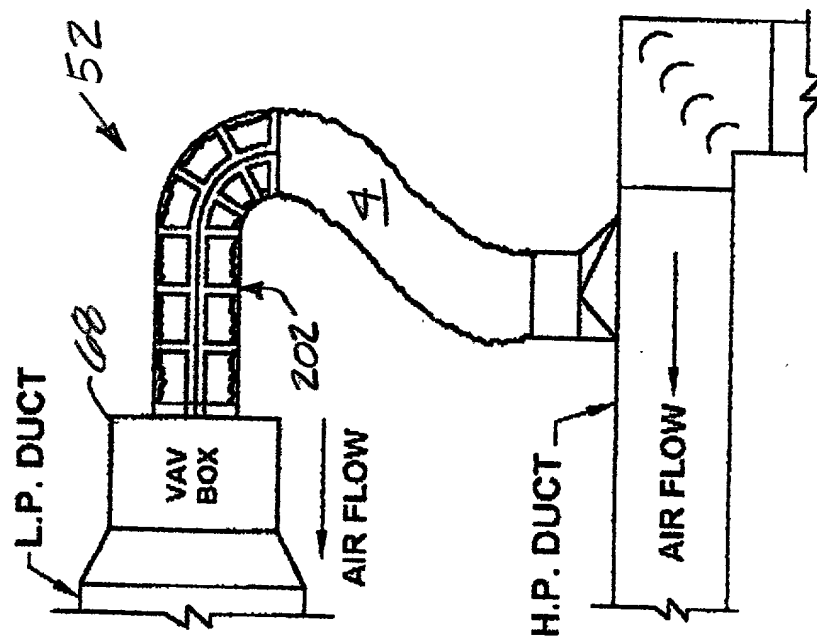


FIG. 6

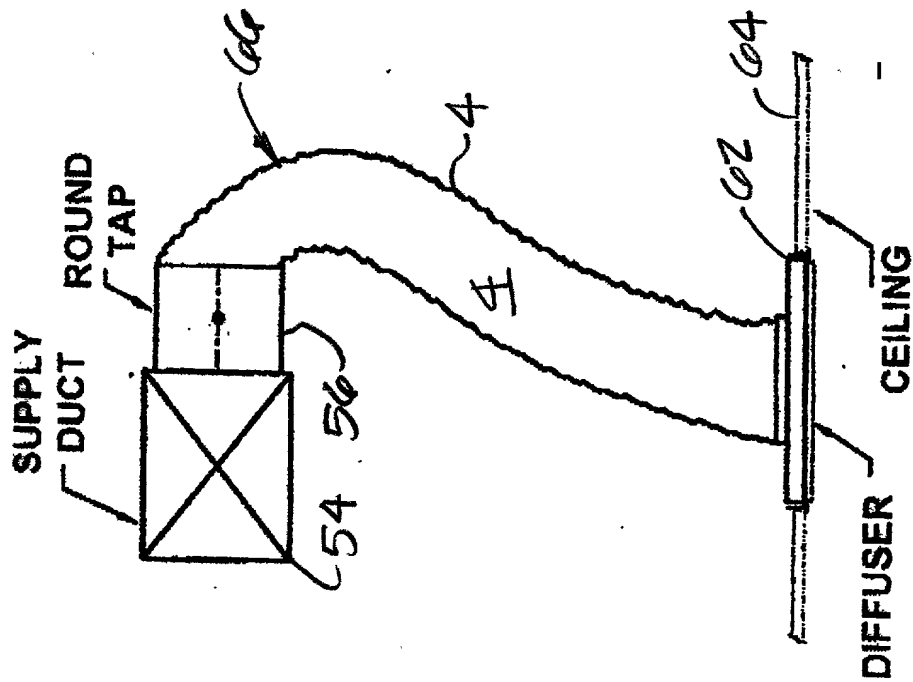


FIG. 5a

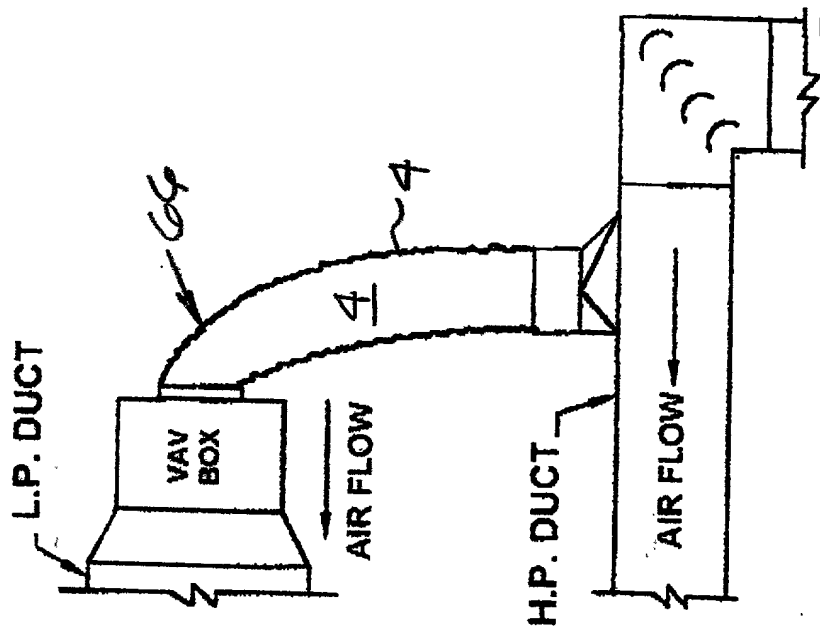


FIG. 6a

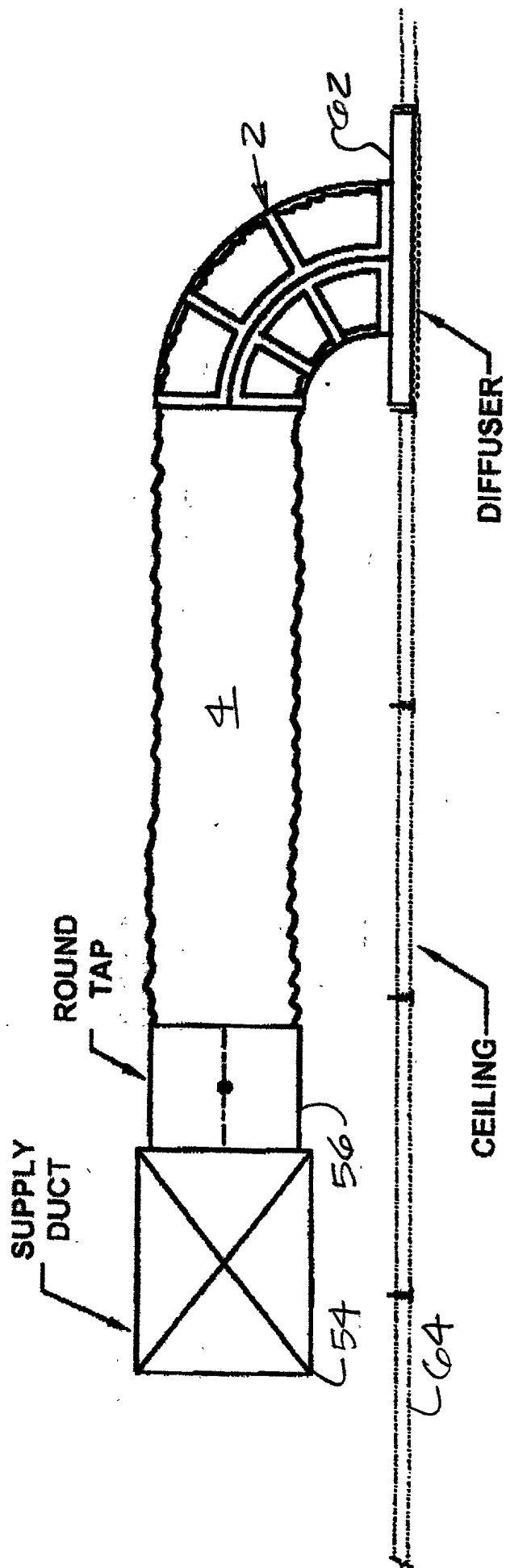


FIG. 7

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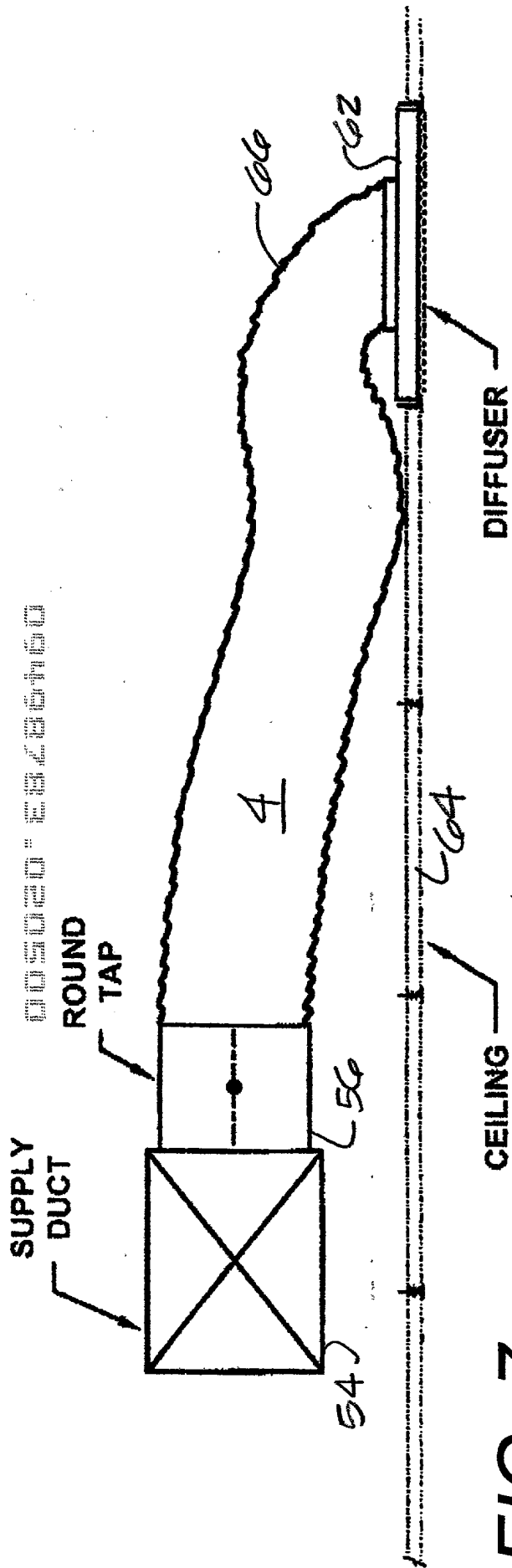


FIG. 7a

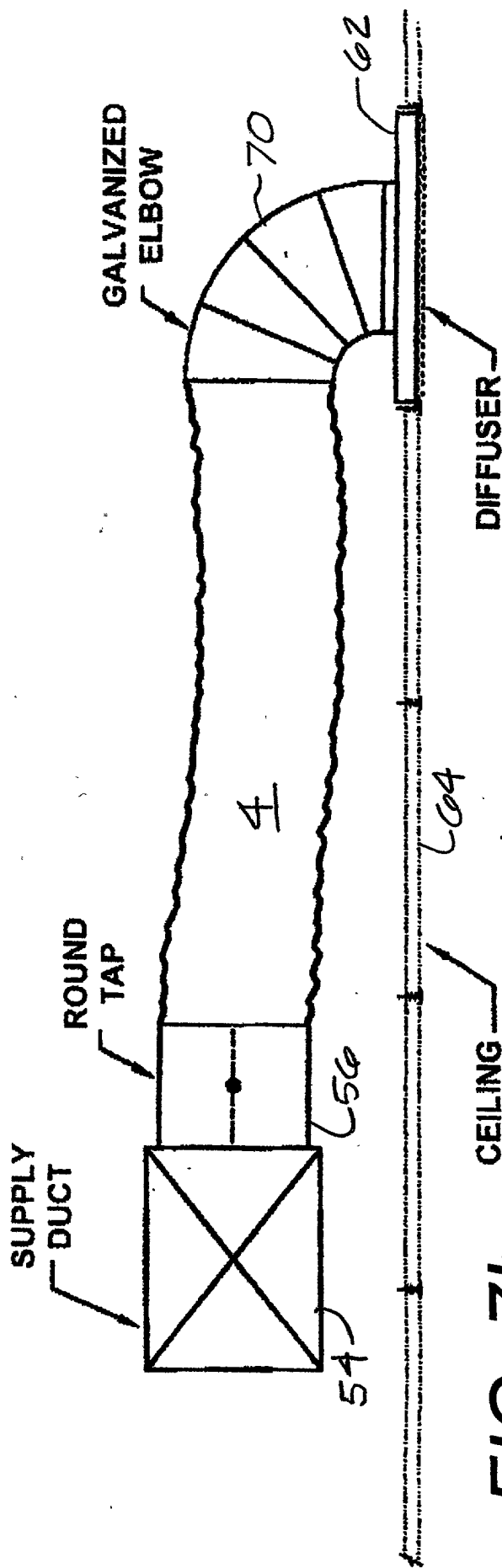


FIG. 7b

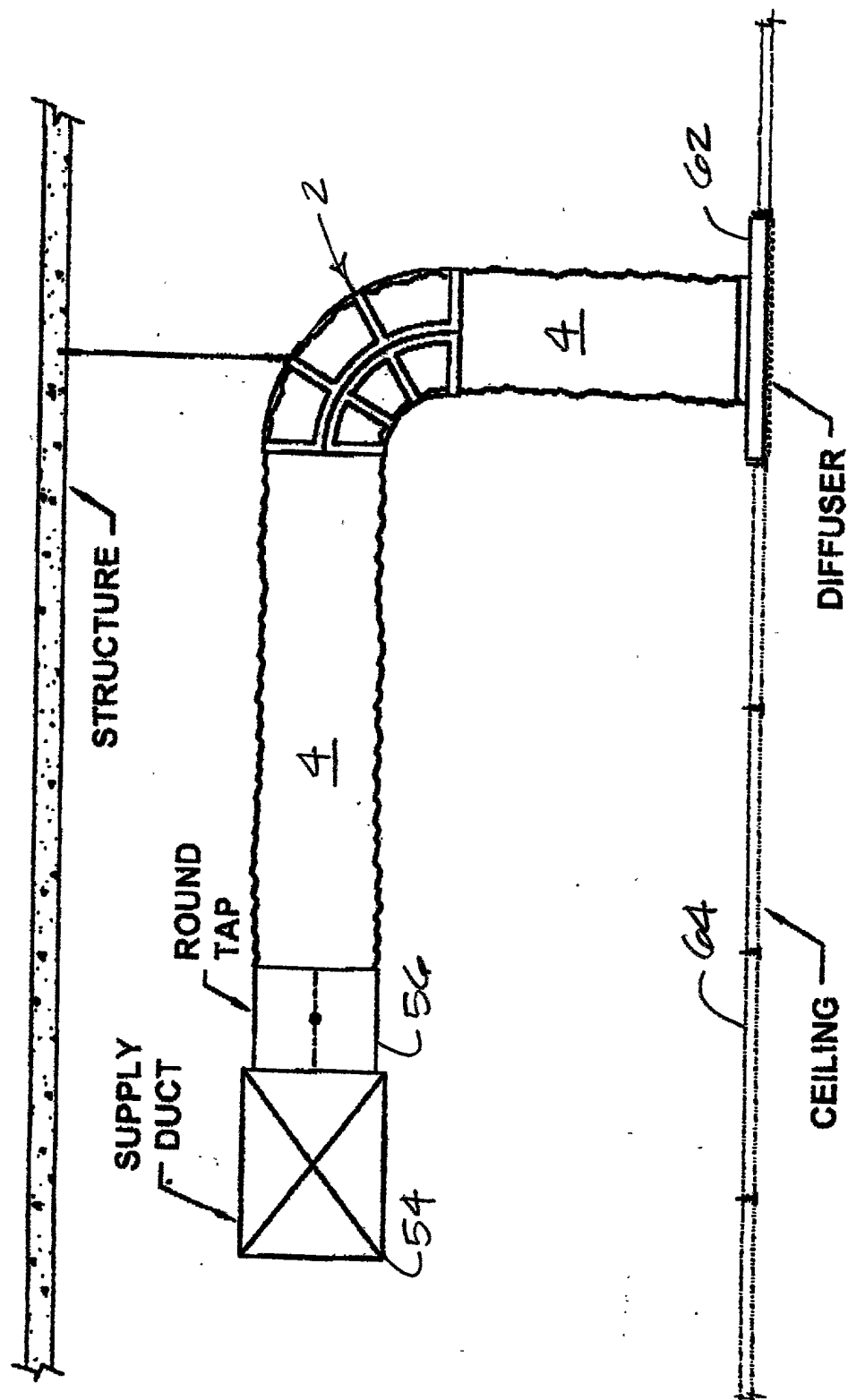


FIG. 8

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DECLARATION AND POWER OF ATTORNEY
FOR A PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled FLEXIBLE DUCT SLEEVE, the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Sec. 1.56. (Under Sec. 1.56 information is material to patentability when it is not cumulative to information already of record before the Patent and Trademark Office with respect to the present application and it establishes either by itself or in combination with other information a prima facie case of unpatentability of a claim or it refutes or is inconsistent with a position taken in opposing an argument of unpatentability relied upon by the Patent and Trademark Office or in asserting an argument of patentability. Under this section a prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.)

I hereby state that I do not know and do not believe that the invention was ever known or

used in the United States of America before my invention thereof; that to the best of my knowledge and belief the invention has not been in public use or on sale in the United States of America more than one year prior to this application, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, or patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application; and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns.

I hereby appoint Malcolm A. Litman, Reg. No. 19,579; Gerald M. Kraai, Reg. No. 34,854; Mark E. Brown, Reg. No. 30,361; Kent R. Erickson, Reg. No. 36,793 and Marcia J. Rodgers, Reg. No. 33,765 all members of the bar of the State of Missouri, whose postal address is Litman, Kraai & Brown, L.L.C., 4700 Belleview, Suite 200, Kansas City, Missouri 64112, telephone (816) 931-1800 as my attorneys, with full power of substitution, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith in my behalf.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States

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